

WHAT IS CLAIMED IS:

1. A vehicle dynamics behavior reproduction system for adapting cornering stiffness to driving situation of a motor vehicle in order to describe accurately behavior of the motor vehicle on the basis of various information derived from outputs of on-vehicle sensors without being influenced by said driving situation of the motor vehicle, comprising:

vertical wheel force arithmetic means for arithmetically determining a load applied to each of wheels of said motor vehicle as a vertical wheel force;

lateral wheel force arithmetic means for arithmetically determining a lateral wheel force acting on each of said wheels;

cornering stiffness adaptation means for effectuating adaptation of the cornering stiffness at each of said wheels to said driving situation;

a state space model/observer unit for determining solutions of simultaneous differential equations relating to a dynamics theory of the motor vehicle for calculating variables involved in said dynamics theory;

a selector for selecting a specific signal as required from signals representing said solutions generated by said state space model/observer unit;

delay means for delaying said specific signal on a predetermined unitary time basis; and

tire side slip angle arithmetic means for arithmetically determining a tire side slip angle at each of said wheels in view of said driving situation,

wherein said state space model/observer unit includes a state space observer designed for determining variables which can not straightforwardly be measured.

2. A vehicle dynamics behavior reproduction system according to claim 1,

wherein said lateral wheel force arithmetic means is designed to approximate the lateral force F_y at each of said wheels in accordance with

$$F_{yij} = \left[k_1 - \frac{F_{zij}}{k_2} \right] \cdot F_{zij} \cdot \arctan(k_3 \cdot \alpha_{ij}) \quad (1)$$

where F_z represents said vertical wheel force,

α represents said tire side slip angle, and

k_1 , k_2 and k_3 represent constant parameters specific to the tire.

3. Avehicledynamicsbehaviorreproductionsystemaccording to claim 1,

wherein said cornering stiffness adaptation means is designed to effectuate adaptation of the cornering stiffnesses of the individual wheels, respectively, to the driving situation on a predetermined unitary time basis in accordance with an undermentioned adaptation equation:

$$\begin{aligned} c_{ij}(t_k) &= \frac{F_{yij}(t_k)}{\alpha_{ij}(t_k)}, \text{ if } \alpha_{ij}(t_k) \neq 0 \\ c_{ij}(t_k) &= \text{const.}, \text{ if } \alpha_{ij}(t_k) = 0 \end{aligned} \quad (2)$$

where $c(t)$ represents the adapted cornering stiffnesses at the wheels, respectively, at a time point \underline{t} ,

$F_y(t)$ represents the lateral forces of the wheels, respectively, at the time point \underline{t} ,

$\alpha(t)$ represents the side slip angles of the tires, respectively, at the time point \underline{t} , and where

const. represents a constant used to describe the cornering stiffness in linear vehicle model theory.